

Recommendation ITU-R RA.2178-0

(06/2026)

RA Series: Radio astronomy

Global geodetic very long baseline interferometry networks

Foreword

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Series of ITU-R Recommendations

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Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radio-wave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R RA.2178-0

Global geodetic very long baseline interferometry networks

(2026)

Scope

This Recommendation describes Geodetic Very Long Baseline Interferometry (VLBI) observations, which are required to deliver data products of utmost importance to a wide range of governmental, economic, societal, and scientific purposes, and recommends that administrations provide assistance in avoiding harmful interference to the stations of the International VLBI Service for Geodesy and Astrometry.

Keywords

Geodetic very long baseline interferometry, radio astronomy service, VLBI global observing system, geodesy, interference

Abbreviations/Glossary

RAS Radio astronomy service

VLBI Very Long Baseline Interferometry

Related ITU-R Recommendations and Reports

Recommendation ITU-R P.452 – Prediction procedure for the evaluation of interference between stations on the surface of the Earth at frequencies above about 0.1 GHz

Recommendation ITU-R TF.460 – O Time signals and frequency standards emissions

Recommendation ITU-R RA.517 – Protection of the radio astronomy service from transmitters operating in adjacent bands

Recommendation ITU-R RA.611 – Protection of the radio astronomy service from spurious emissions

Recommendation ITU-R P.676 – Attenuation by atmospheric gases and related effects

Recommendation ITU-R RA.769 – Protection criteria used for radio astronomical measurements

Recommendation ITU-R RA.1031 – Protection of the radio astronomy service in frequency bands shared with active services

Recommendation ITU-R RA.1513 – Levels of data loss to radio astronomy observations and percentage-of-time criteria resulting from degradation by interference for frequency bands allocated to the radio astronomy service on a primary basis

Recommendation ITU-R M.1583 – Interference calculations between non-geostationary mobile-satellite service or radionavigation-satellite service systems and radio astronomy telescope sites

Recommendation ITU-R RA.1631 – Reference radio astronomy antenna pattern to be used for compatibility analyses between non-GSO systems and radio astronomy service stations based on the epfd concept

Recommendation ITU-R RS.2066 – Protection of the radio astronomy service in the frequency band 10.6-10.7 GHz from unwanted emissions of synthetic aperture radars operating in the Earth exploration-satellite service (active) around 9 600 MHz

Recommendation ITU-R M.2101 – Modelling and simulation of IMT networks and systems for use in sharing and compatibility studies

Recommendation ITU-R P.2108 – Prediction of clutter loss

Recommendation ITU-R P.2109 – Prediction of building entry loss

Report ITU-R RA.2126 – Techniques for mitigation of radio frequency interference in radio astronomy

Report ITU-R RA.2131 – Supplementary information on the detrimental threshold levels of interference to radio astronomy observations in Recommendation ITU-R RA.769

Report ITU-R RA.2188 – Power flux-density and e.i.r.p. levels potentially damaging to radio astronomy receivers

Report ITU-R RA.2259 – Characteristics of radio quiet zones

Report ITU-R RA.2428 – Parameters needed for the registration of distributed radio astronomy systems

Report ITU-R RA.2507 – Technical and operational characteristics of the existing and planned Geodetic Very Long Baseline Interferometry

The ITU Radiocommunication Assembly,

considering

- a) that Very Long Baseline Interferometry (VLBI) is the most accurate measuring technique to determine positions in the universe and on Earth, and is therefore a fundamental tool for science and applications in radio astronomy and geodesy;
- b) that Geodetic VLBI products are the Celestial Reference Frame, the Terrestrial Reference Frame, and the associated Earth orientation parameters such as the position of the rotational axis and the length-of-day. These are used for geodesy, the monitoring of Global Change, and the applications of space navigation and satellite orbit determination;
- c) that Geodetic VLBI is realized by global networks of independent radio telescopes simultaneously observing cosmic radio sources on a daily basis;
- d) that the frequency range 2-14 GHz is most favourable for Geodetic VLBI observations because of the physical properties of the atmosphere in this frequency range, and to meet the performance goals of the global geodetic observing system, a minimum of 32 channels, each with a bandwidth of 32 MHz, is required. Within this range allocations to the radio astronomy service include 2 655-2 670 MHz (secondary), 2 670-2 690 MHz (secondary), 2 690-2 700 MHz (primary), 4 800-4 990 MHz (secondary), 4 990-5 000 MHz (primary), 10 600-10 680 MHz (primary/shared), and 10 680-10 700 MHz (primary), which may not be sufficient to meet the performance goals;
- e) that under certain circumstances the performance of the observations and thus the quality of the geodetic data products may be degraded by the emissions from terrestrial and spaceborne transmitters;
- f) that the Geodetic VLBI stations are part of a global network infrastructure which can only function if all stations in the network can observe at the same time and in the same frequency bands without being disturbed by harmful interference,

further considering

- a) that geodetic VLBI stations operate under the radio astronomy service (RAS);
- b) that Report ITU-R RA.2507 contains technical and operational characteristics of existing and planned Geodetic VLBI systems, provides an operational overview of the worldwide network, and describes strategies to maximize system performance;
- c) that Report ITU-R RA.2507 contains the threshold levels of interference which may adversely affect VLBI observation systems, derived from the levels of interference specified in Recommendation ITU-R RA.769, Table 3;
- d) that Report ITU-R RA.2259 describes the characteristics of Radio Quiet Zones to secure the undisturbed observation of cosmic radiation,

recognizing

that Recommendation ITU-R TF.460 describes UT1 as UT0 corrected for the effects of small movements of the Earth relative to the axis of rotation (polar variation) and these movements are being measured by Geodetic VLBI,

noting

- a)* that the UN General Assembly Resolution 69/266 calls for maintenance of a global geodetic reference frame for sustainable development which requires Geodetic VLBI products;
- b)* that International Astronomical Union General Assembly 2021 Resolution B1 and International Union of Geodesy and Geophysics General Assembly 2023 Resolution 1 calling for action on the protection of Geodetic VLBI;
- c)* that United Nations Global Geodetic Centre of Excellence calls for safeguarding VLBI radio-frequencies through its policy brief number 3;
- d)* that the further development of VLBI would benefit from administrations seeking to support observatories in research and development of methods of interference mitigation, including enhancing receiver resilience and data analysis techniques,

recommends

- 1 that administrations consider taking into account that the use of Geodetic VLBI data is fundamental to other radiocommunication services, as documented in Report ITU-R RA.2507;
 - 2 that administrations consider, if appropriate, registering their Geodetic VLBI sites in accordance with Radio Regulations No. **11.12** as RAS stations in bands allocated to the RAS.
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